

STRIKE FORCE: ON TRACK OR TIME TO REINVENT THE WHEEL?

**A MONOGRAPH
BY
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Field Artillery**



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ABSTRACT

Strike Force: On Track or Time to Reinvent the Wheel?
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The Army recognizes that a medium-weight contingency force would be well suited to meet national security requirements for the twenty-first century. This medium-weight force would have an ability to deploy more quickly than heavy armor formations, yet possess more combat power than current light forces. With this vision in mind, force designers set out to build the Strike Force.

The problem is that the original vision of a re-equipped standing Strike Force has been cancelled in favor of creating only a Strike Force headquarters that would draw units from across the Army prior to deploying. In an 18 January 1999 interview in *Army Times* the Chief of Staff of the Army, General Dennis Reimer indicated that the rationale for his decision was not the estimated \$1.1 billion price tag associated with a standing Strike Force, but rather centered on the desire to build a more adaptable force than would be possible if permanent units were assigned.

Analysts have criticized the decision asserting that the Army may not have the right forces or equipment required by the Strike Force. Specifically, several military analysts believe the Strike Force should be equipped with a wheeled vehicle, rather than tracks which is the only type of combat system that exists in the Army.

The monograph begins with an examination of the Strike Force concept and the environment in which it is expected to operate. Because any conflict has two sides, the environment is not only considered from an American viewpoint, but also from the view of what threats the organization may face. The advantages and disadvantages of using a wheeled and tracked Strike Force vehicle are derived from this information. The wheeled version is found to have better strategic and operational transportability and enjoys better supportability, while the tracked vehicle would likely have better tactical mobility and be more survivable.

Finally, the monograph analyzes these findings with respect to the patterns of operation identified in *Army Vision 2010*. The wheeled vehicle is greatly favored with respect to projecting the force and sustaining the force, while being only slightly disadvantaged in the remaining criteria. The monograph concludes that analysts were correct in asserting that a wheeled Strike Force combat system would be better than a tracked version.

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I. Introduction

A man who...intends to build a good instrument of war must first ask himself what the next war will be like. And he must try to find an answer which approximates most closely the reality of the future war, for the closer that approximation, the more suitable for dealing with future reality will be his instrument. Research into the war of the future is not, therefore, an idle pastime. It is, rather, an ever-present practical necessity.¹

Although written by Italian air power theorist, Giulio Douhet, over seventy-five years ago these words are as applicable today as ever. The absence of a well-defined threat, the lack of unlimited fiscal resources, and the incredible pace of technological change, have all combined to make finding a balance between an Army prepared to defend vital national interests and an Army sufficiently flexible to fulfill lesser duties extremely complex. What is clear is that the future Army must be an adaptable force, which is able to respond quickly with overwhelming combat power to a crisis anywhere in the world. According to the former TRADOC Commander, General William W. Hartzog, this future Army will consist of four major groups of combat forces: Special Operation Forces, Strike Forces, Contingency Forces, and Campaign Forces.² This monograph only deals with one slice of that future Army, the Strike Force.

As reported in a 4 January 1999 article in *Army Times*, "TRADOC officials spent the past year outlining the need for a rapidly-deployable medium-weight force that can get to a crisis faster than today's armor and mechanized units, but that packs a heavier punch than the airborne troops who are usually the first conventional soldiers into a combat zone."³ This force is the Strike Force.

Recently, the Chief of Staff of the Army made a decision to only establish a Strike Force headquarters as opposed to the TRADOC option that called for a complete Strike Force with appropriately equipped, permanent troop units assigned. Under the "headquarters only" concept, units would be drawn from across the Army and task organized under the Strike Force headquarters prior to deployment. Critics have expressed growing discontent with this concept questioning what value this command and control organization would have over current rapid deployment headquarters and what types of equipment would be most appropriate for it.⁴

At the heart of the Army's dilemma is the fact that it lacks "medium" forces. With six heavy armored and mechanized divisions and three air transportable or light divisions, the Army has taken on a certain "barbell characteristic." Only the 101st Air Assault Division, with its aviation brigade, can arguably span the current gap between U.S. heavy and light forces.⁵

While heavy forces have the inherent firepower and protection necessary for success on the future battlefield, they are not easily, nor quickly transportable. Based on OPERATION DESERT STORM one can only assume that any future opponent learned at Iraqi expense that the U.S. should not be afforded the time necessary to deploy heavy forces required to build the combat power currently lacking in its early-entry forces. The challenge of deploying heavy units was again demonstrated several years later in OPERATION JOINT ENDEAVOR, when it took nearly two months to deploy a single heavy brigade from Germany to Bosnia via rail and road networks.⁶ Admittedly, what heavy

units do lack in strategic and operational mobility they make up for in firepower and protection.

Conversely, light units are relatively easy to deploy, but lack the protection and firepower on most battlefields to be decisive. One need only consider the role of the U.S. light divisions in OPERATION DESERT STORM to realize that the “lightness” which makes these units easily transportable, also makes them extremely vulnerable to enemy direct and indirect fires.⁷

Clearly a “medium-weight” force which would be more deployable than current heavy forces, but have greater punch in terms of firepower, survivability, and mobility than light forces, would be well suited to fulfill future early-entry roles. TRADOC initially designed the Strike Force to give the U.S. a rapidly deployable, hard hitting force that was “fully capable to stabilize a crisis and, if it turns to conflict, to be able to shape the environment early on.” As originally conceived the force would be a 3,000-5,000 soldier, medium weight, early-entry unit, capable of deploying anywhere in ninety-six hours. Notably, under the TRADOC proposal the unit would have been re-equipped with “off-the-shelf systems” such as the Marine Corps’ eight-wheeled light armored vehicle.⁸

The Chief of Staff of the Army cancelled this concept of a standing Strike Force composed of fixed troop units with an estimated cost of \$1.1 billion in favor of creating only a headquarters indicating the latter would be more “adaptable.”⁹ Under the approved Strike Force headquarters proposal, the organization would deploy into a combat theater with a tailored collection of units selected from across the Army based on mission requirements. A concern is that the Strike

Force may be overly restricted and not have access to the right equipment as a result of only task organizing from current Army units. Specifically, several force designers have speculated that the optimum balance between tactical combat power and the need for rapid strategic deployability can best be realized with wheeled combat systems; therefore, the basic combat vehicle of the Strike Force needs to be a wheeled platform. If these analysts are correct about the necessity of wheels on the future battlefield, this presents the Strike Force with a dilemma because wheeled combat systems do not currently exist in the Army.

It appears then that the question of what type of combat system the Strike Force requires rests at the foundation of the organization's design and future relevance. This monograph analyzes the required capabilities of the Strike Force and the threat that it may face as a future early-entry force to answer the research question: Would a wheeled vehicle be better than a tracked vehicle as the Strike Force primary combat system? The significance of this question becomes self-evident considering the complete absence of wheeled combat systems in the current Army inventory.

Before explaining the methodology for answering this question and in order to more completely deal with the subject matter, this monograph is limited in a number of significant ways. First, whether the Strike Force concept is the best early-entry option for the U.S. Army on the future battlefield is intentionally not addressed. While the answer to this question is extremely important and necessary to avoid creating duplicative forces it is beyond the scope of this paper. Similarly, while analyzing the capabilities of both wheeled and tracked

vehicles operating under the Strike Force concept, fiscal restrictions are not considered. While these constraints do exist for a nation operating with finite fiscal resources, this paper ignores them in order to avoid stifling creative thought.

Finally, in addition to these limitations, the monograph makes several assumptions in conducting the research and in analyzing the results. As is true of any research involving a "conceptual" force which has not yet been developed, this monograph assumes that the Strike Force that is ultimately created will have the capabilities and characteristics indicated in TRADOC publications and outlined in Section II of this paper. The risk is that for a number of reasons, such as the inherent uncertainty of predicting the future and the reality of limited fiscal resources, the final Strike Force may not look like or be employed as originally conceived. This assumption is necessary because the anticipated mission profile for an organization is a primary factor in the type of combat system it requires.

The basis of this monograph is to conduct an operational analysis to determine whether a wheeled vehicle or a tracked vehicle is best suited for the environment, employment concept and anticipated threat facing Strike Force. To do this, material from a number of different sources must be brought together and laid as a foundation. First, in order to establish a base of knowledge research will focus on defining what capabilities the organization needs and what the current concept for employing this force is. Second, the monograph concentrates on identifying the Strike Force's anticipated operational

environment. Specifically, research will orient on exploring what the 2010-2025 battlefield is expected to look like and what type of enemy the U.S. may face in this time period. With this research complete the monograph next analyzes the advantages and disadvantages of using a wheeled and tracked combat vehicle as the Strike Force primary combat system. With this information, the monograph evaluates the advantages and disadvantages of a wheeled Strike Force vehicle versus the advantages and disadvantages of a tracked Strike Force vehicle to arrive at the answer to the research question.

The evaluation criteria this monograph applies to arrive at the conclusion center on the fact that the Strike Force vehicle is designed to help give the force the physical capability to defeat the enemy. *Army Vision 2010*, the “conceptual template” for the future direction of the Army, identifies a deliberate set of patterns of operations through which Army elements do just this. “The patterns are: Project the Force; Protect the Force; Shape the Battlespace; Decisive Operations; Sustain the Force; and Gain Information Dominance.”¹⁰ With the exception of “gaining information dominance” which is fundamental to all the others, the first five patterns of operations help identify the physical capabilities of a military force.¹¹ Consequently, for the advantages of a wheeled combat system to outweigh those of a tracked system for the Strike Force they must do so within the framework of these first five patterns of operation identified in *Army Vision 2010* and highlighted above. For this reason, the monograph uses these patterns as evaluation criteria to answer the research question.

II. Strike Force Concept

Strike Force is about a new concept of being able to deploy an adaptable force with multiple functions to meet the different threats that we face.¹²

Army Chief of Staff General Dennis Reimer

Before undertaking an analysis of what type of vehicle, wheeled or tracked, would be best suited for the Army's future Strike Force, it would seem logical to first consider in some detail what exactly the Strike Force is intended to be and do. In this light and in keeping with Giulio Douhet's earlier warning to consider the purpose of the tool before designing it, this chapter outlines the current Army thought on the Strike Force's intended purpose, characteristics, and concept for employment.

Purpose

While there are a number of different visions among the Army's senior leaders on exactly what the Strike Force will ultimately look like, what everyone seems to agree on is the driving intent behind creating it. The purpose behind the Strike Force as articulated by Army Training and Doctrine Command (TRADOC) officials is twofold. It is intended to be both an experimentation force and a future contingency force.

In the Preface to the *1998 Annual Report on Army After Next (AAN)* General John N. Abrams, Commander of TRADOC, indicated that "the Strike Force is envisioned to embody the concepts and ideas emerging from the AAN

process, within the limits of technology."¹³ In this way, Strike Force would serve "as a stalking horse for new technologies and designs" that can be a part of the 2010-2025 era Army After Next.¹⁴

As General Reimer indicated at the beginning of this chapter in addition to having an "experimental" purpose Strike Force is also intended to serve as a future contingency force – "a force light enough to deploy quickly, yet armed and protected well enough to hold its own against a lethal enemy force."¹⁵ As a contingency or early-entry unit, Strike Force would fulfill "a need for a medium-weight force that is deployable within about ninety-six hours, that has decisive deterrence capability when it arrives in theater."¹⁶ When unveiling the Army's reengineered heavy combat division structure for Army XXI, then Commander of TRADOC, General William W. Hartzog indicated that Strike Forces would be "new continental U.S.-based, combined arms formations that will be developed to assume the rapid-deployment missions that today are performed by heavy division ready brigade combat teams and task forces."¹⁷

Characteristics

In order to serve as an experimental unit that will also be a future contingency force for the U.S. Army, force designers anticipate that Strike Force will have several unique features. Three of these characteristics, namely its size, tactical mobility, and strategic deployability, help to better visualize how Strike Force might actually look and what type of vehicle might best fit its needs.

Somewhat reminiscent of British armor warfare theorist Brigadier Richard E. Simpkin's "airmechanized" units, Strike Force will be a small, self-sufficient organization.¹⁸ Although the majority of forces will remain ground units, force developers envision the Strike Force having a larger percentage of aviation assets than today's units.¹⁹ In terms of size, Strike Force is expected to be somewhat similar to a current brigade. While General Hartzog has indicated that the Strike Force could be as large as 5,000 soldiers, most estimates appear to place the unit closer to 3,000.²⁰ One of the greatest challenges facing the Strike Force is the need to increase its self-sufficiency by greatly reducing its logistical requirements most of which for a mechanized force is ammunition and fuel. The goal for Strike Force is to be able to sustain itself for up to two weeks without a major resupply.²¹ This task seems especially daunting since force designers see the unit as being "heavy in indirect fire." In order to keep the Strike Force tactical "footprint" as small as possible, the unit is expected to have habitual links to non-organic support capabilities, such as air and missile defense coverage, national-level intelligence sources, additional fire support, combat service support augmentation, and nuclear, biological, and chemical (NBC) decontamination assets.²²

In addition to being a small and self-sufficient organization, Strike Force will also be a highly mobile force with the agility to mass and disperse quickly. The latest report on Army After Next indicates that "speed must increase by a factor of two or more to overcome the strength of a knowledge- and precision-based defense."²³ Force designers expect that this "will only be possible by rotating the

traditional two-dimensional orientation of ground forces into the vertical dimension.”²⁴ In other words the Strike Force must have an inherent tactical airlift capability.

The final characteristic of Strike Force is that it will be rapidly deployable. With the inherent difficulty of moving heavy forces to distant theaters and the current and foreseeable shortage in U.S. sealift and airlift, Army After Next researchers correctly recognized that “the fundamental challenge facing military planners, once the National Command Authorities (NCA) decide to use military force, is the race to establish military capability in the troubled theater.”²⁵ Facing an opponent who likely has the advantage of making the first move, U.S. efforts to resolve a crisis peacefully rest largely on an ability to get lethal forces in theater before the enemy has the ability to “set” his force to attack. This idea of “moving so fast and with such lethality that enemies cannot set forces and operate at an advantage” is defined in Army After Next terminology as strategic preclusion.²⁶ The need for lethality and speed is the impetus behind Strike Force and serve as its defining characteristics.

Concept of Employment

The concept for employing the Strike Force centers on the fact that it would be a medium-weight, rapidly deployable, “heavy hitting” contingency unit. With the ability to deploy a lethal combat force in under ninety-six hours, Strike Force would be sufficient to deal with the smaller scale obligations inherent in being the Army of the sole remaining world super power. Likewise, in larger contingencies,

it could shape the conflict and hold the line until heavier armored and mechanized forces arrived in theater. In an 18 January 1999 article in *Army Times*, General Reimer cast additional light on the possible employment concept for Strike Force indicating four capabilities that Strike Force might include. They are: an airfield seizure capability, an air assault capability, an urban warfare capability; and protection against electromagnetic pulse.²⁷ In summary, having looked at its purpose, characteristics, and concept for employment, it is apparent that Strike Force is designed to "operate at an increased tempo, be more survivable in combat, more agile in deploying, pack a more lethal punch, and be more responsive to a rapid change in plans than any predecessor."²⁸

III. The Future Battlefield

In addition to understanding the purpose and characteristics of Strike Force, consideration must also be given to the environment in which it could operate in order to analyze what type of combat system, wheeled or tracked, might best suit it. Perhaps the great Prussian military theorist, Carl von Clausewitz, best captured the essence of this environment in his military classic, *On War*, when he stated that "countless duels go to make up war, but a picture of it as a whole can be formed by imagining a pair of wrestlers. Each tries through physical force to compel the other to do his will."²⁹ In this light, any consideration of Strike Force's role in the future Army must not only address how the Army envisions that battlefield to look, but also how it expects potential threat environments to evolve.

The purpose of this section is to address the first portion of Strike Force's operational environment; namely what the U.S. Army expects the future battlefield to look like. Since the Strike Force is intended to be both a near-term "medium weight" contingency force and a longer term experimental force, the future that concerns us includes not only Force XXI, the vision of the Army in the early 21st Century, but also the Army After Next (AAN), the Army that will follow Force XXI.

To meet the challenges of adapting the current Army for the period from the present to about the year 2010, General Gordon R. Sullivan, while serving as the Army Chief of Staff, took the initiative to begin development of Force XXI. Since

1994 Force XXI, through a series of field-tests, doctrine development initiatives, and acquisition programs, has been further defined and better developed. While it is true that the international security environment can be expected to remain unpredictable, one element that will not change is the U.S. Army's resolve to be prepared to meet future challenges.³⁰

The U.S. Army's Training and Doctrine Command (*TRADOC*) *Pamphlet 525-5, Force XXI Operations*, identifies five defining characteristics of Force XXI: doctrinal flexibility; strategic mobility; tailorability and modularity; joint and multinational connectivity; and versatility to function in War and Operations Other than War.³¹ By considering each of these characteristics in turn certain fundamental expectations are identified about the environment in which Strike Force will need to operate.

The first characteristic, doctrinal flexibility, embodies the idea of being able to adapt the "way" the Army fights to the specific scenario at hand. More recently, the latest revised Draft of U.S. Army Field Manual 100-5, *Operations*, identifies two "timeless truths of doctrine." First, an Army must not assume a willing opponent and therefore adopt a doctrine that is too narrow or prescriptive. Second, in war, the side that is best prepared mentally to adapt will reap a significant advantage.³² The overriding idea in this characteristic seems to be that the future battlefield will continue to require soldiers with the mental agility to assess the situation quickly and adapt their actions to control the environment quickly.

Recognizing the uncertainty of the strategic environment and the constraints, both economic and political, that deny a nation the ability to station forces around the world, the Army will remain a power projection force. The second characteristic of the Force XXI battlefield, strategic mobility, "is about being in the right place at the right time with the right capabilities."³³ History has shown that the early phases of a crisis are the most crucial. "If U.S. forces arrive in a theater promptly and are prepared to operate immediately, a crisis may be averted or may be stabilized enough to allow an orderly build-up of forces."³⁴

The third characteristic, tailorability and modularity, acknowledges that through advances in information technologies that "organizations will tend to grow flatter and less rigidly hierarchical." Additionally, limitations in strategic lift, the need to respond rapidly, and the unavailability of sufficient air or sea ports in the area of operations, all suggest that to maintain flexibility the future forces be as "modular as logic allows to facilitate tailoring to meet each contingency."³⁵

No service or governmental agency has the singular ability to achieve success in the next war. Similarly, while the U.S. has the ability to act unilaterally to protect its national interests, often its interests are consistent with other nations. Seldom, therefore, does the U.S. pursue its interests alone. Joint, Multinational, and Interagency connectivity is another important characteristic of the future battlefield.³⁶

The final characteristic represents a fundamental fiscal truth in the next century; nobody can afford to man, train, or equip a separate army tailored for each specific operational environment. Each nation, instead, will strive to build a

force that has the versatility to win its nation's wars, as well as protect its national interests in "lesser conflicts." As outlined in Army Vision 2010, the Army's blueprint for the future, the force's versatility will be due to "modern technologies that will exploit situational understanding phenomena to enable tailored, still undefined combat organizations to task organize quickly and fight dispersed with extraordinary ferocity and synchronization."³⁷

As stated earlier, only considering the Force XXI time period in defining Strike Force's potential operational environment paints an incomplete picture. With expectations of strongly augmenting "the Army's early-entry capability in 2025," Strike Force will undoubtedly be around in the time frame of the Army After Next (AAN), a program designed to conceptualize the geostrategic environment thirty years into the future.³⁸

In the mid-1990s Army Chief of Staff General Dennis J. Reimer commissioned Headquarters, Training and Doctrine Command (TRADOC) to begin "an exploratory program to investigate the possible shape and behavior of the Army in the 2025 time frame."³⁹ The need for this "Army After Next" program was threefold. First, many of the pieces of equipment purchased in the 1980s were scheduled to reach the end of their life cycle around 2010. Second, the pace of technological change had become so quick that the only way to ward off obsolescence was with an unconstrained and long-term view to the future. Finally, the uncertainty of the geopolitical world also warranted a long-term approach to address potential security challenges.⁴⁰ Under General Reimer's directive the Army After Next process offered an unconstrained, futuristic think

tank to consider issues in four areas: the geostrategic setting; the evolution of military art; technology; and human and organizational issues.⁴¹ Each year the Army After Next team presents a study to the Army Chief of Staff detailing their findings with respect to these four broad research areas.

“Army After Next study and research efforts over the last year and a half clearly identified knowledge and speed as the central themes for the Army of 2025.”⁴² In this context, the AAN team has come to several conceptual conclusions that help one visualize what the outline of the Army may look like in 2025. Three of these conclusions are especially insightful for Strike Force.

The first conclusion and “one of the most important insights of the AAN Project is that strategic preclusion and rapid strategic maneuver must form the core concepts for the future joint force.”⁴³ Together these concepts capture the realization that the future Army must become dramatically more deployable, while at the same time leveraging technology to become more lethal. The essence of strategic preclusion is being able to move so quickly and with such overwhelming combat power that an opponent is “precluded” from being able to set his force for aggressive action.⁴⁴ “Strategic maneuver circa 2025 envisions rapid movement over global distances of highly lethal air, land, sea, and space capabilities to converge with overwhelming power upon the enemy centers of gravity and then to cause the rapid disintegration of the opponent.”⁴⁵ By responding rapidly, options once open to the enemy will be closed off allowing U.S. forces to wrest the initiative away from him. In this manner, besides being a credible deterrent to potential aggressors, strategic preclusion and maneuver

"mitigate risk at the front end of a campaign and help to create conditions for early termination."⁴⁶

In order to make strategic preclusion and strategic maneuver a reality, the *1998 Army After Next Annual Report* highlights several key constraints that must be overcome in current forces. First, "all elements of the 2025 hybrid force need to be lightened" so they will be more strategically and operationally transportable, agile, and sustainable.⁴⁷ With respect to this "lightening" the *Annual Report* identifies the most critical areas for improvement as the need for reductions in the size of units; weight reductions in ground combat platforms; reductions of support processes and structures; and reductions in logistical requirements.⁴⁸ The second key constraint that must be overcome is that "the enormous demand for fuel and its supporting force structures must be reduced."⁴⁹

While no one can predict what the Army's force structure will look like in 2025, one can assume with relative certainty that the force will consist of very expensive pieces of equipment being operated by highly skilled and well-trained soldiers. The AAN team's second conclusion, that the future Army must avoid attrition warfare, follows from this revelation. "Some combination of precision fires and dominant maneuver should permit U.S. land forces to hit where they choose, and deny an enemy the opportunity to entrap U.S. forces in wearing and inconclusive combat."⁵⁰ Maximum use would be made of very long range or "non-line-of-sight fires" to preclude human casualties. As alternate propellants are developed, even longer-range fires might reduce the actual number of systems needed on the battlefield, since effects could be massed without

physically massing weapon systems.⁵¹ Interestingly, the latest findings from AAN research state that the defense will be greatly strengthened in the future and that offensive action will likely only be possible if an opponent's precision fire system is seriously degraded and there are "sharp increases in the mobility and speed of the maneuvering formation."⁵²

The final conclusion is directly related to "lightening" the force and asserts that the Army After Next must be as self-sustainable for as long as possible. "Shrinking the logistic tail to the theater of operations and on the battlefield itself is a fundamental goal in fielding AAN-era fighting forces."⁵³ In the Army After Next "it's possible that the bulk of logistics and administrative support may be based outside the active theater of operations, beyond the reach of most threats, which would free up combat units to concentrate on active operations instead of security."⁵⁴

In summary, Strike Force's potential environment can best be described as fast - faster deployments, faster information processing, faster decision making, faster engagements, faster maneuvering, faster finishing, and ultimately, faster decisions.⁵⁵ High tempo operations should be expected, in which time becomes compressed and what is traditionally thought of as deep, close, and rear, meld together in a torrent of long-range accurate fires followed by rapid moves to close with the enemy before he reacts. Speed will be more essential in the future as widely dispersed and non-contiguous forces conduct non-linear and distributed operations, massing effects and not units to avoid casualties. This seems to be the environment in which the Strike Force will exist.

IV. Potential Threat Environments

No plan survives contact with the enemy.

Field Marshal Helmuth von Moltke⁵⁶

In a 1995 Land Warfare Paper, Douglas A. MacGregor, a U.S. Army officer and noted military author, postulated that "because technology is developing so rapidly, it is hazardous to assume too much about the details of possible future threats."⁵⁷ While analysts must be cautious of predicting the details of tomorrow's threats, it would be equally hazardous to ignore the evolution of these threats entirely. As Carl von Clausewitz stated "war...is not the action of a living force upon a lifeless mass...but always the collision of two living forces."⁵⁸ Thus, any analysis of the most appropriate combat system for the Strike Force must consider the potential threat environment in which it might operate.

In a 10 February 1998 speech the Chairman of the Joint Chiefs of Staff, General Henry H. Shelton may have best captured the essence of the future threat when he said, "almost certainly we will not face a hostile superpower in the near term, but let me be very clear, the world will remain a dangerous place."⁵⁹ Consistent with General Shelton, the Army After Next project does not predict a "peer competitor with capabilities symmetrical to our own" to develop within the next twenty-five to thirty years.⁶⁰ What researchers do expect is that one and probably two "major military competitors" will emerge. These modernized states, while not having symmetrical military capabilities, would still be capable "of threatening U.S. vital interests or those of our allies within a specific region."

Clearly these potential opponents will recognize that it is not rational to try and “match U.S. capabilities across the board as in the Cold War.” More likely, they will keep a sharp eye on the path the U.S. takes into the future and develop strategies that aim to attack U.S. weaknesses, while negating or avoiding its strengths.⁶¹ Lester W. Grau, a noted military analyst and former Army officer, asserts that future opponents have essentially two options for “blunting our technological edge.” First, an opponent could host the conflict on or draw it into complex terrain “where trained infantry, rather than technological wizardry, is the decisive factor.” The second method would be for the opponent to equip his force with “a select number of off-the-shelf technological systems that negate or seriously disrupt the U.S. technological advantage.”⁶²

A force desiring to use complex terrain to negate an opponent’s technological advantages would “be hard pressed to find an alternative more” ideally suited than an urban environment.⁶³ As highlighted by AAN research, enemy units “located in cities diminish the effect of U.S. information advantages because forces are more difficult to locate, target, and assess.”⁶⁴ Unable to penetrate or see through walls, high tech reconnaissance systems have trouble differentiating not only between friend and foe, but also between combatants and non-combatants.⁶⁵

The Russian experience in January 1995 while fighting Chechen forces in the city of Grozny serves as an example of an outnumbered, technologically inferior force negating the advantages of a more numerous and technologically sophisticated one. Although supported with overwhelming indirect fire, the

Russian forces lost twenty of twenty-six tanks and one hundred two of one-hundred twenty BMPs in the initial battle. To make matters worse, less than two weeks into the fight one-seventh of the Russian forces in the city were infected with viral hepatitis.⁶⁶

The potential for a less technologically advanced force to mitigate the strengths of a more sophisticated opponent, coupled with the global demographic shift from the countryside to the cities, make it unlikely that the U.S. military will avoid urban operations in the future.⁶⁷ In fact, AAN researchers note that "urban operations could become as frequent and routine in the twenty-first century as operations in open terrain have been in the twentieth."⁶⁸ Considering the likelihood of this potential threat environment, the capability to win in complex terrain is an important consideration for the combat system of the Strike Force.

As mentioned earlier the second method for "blunting our technological edge" would be for the opponent to equip his force with "a select number of off-the-shelf technological systems that negate or seriously disrupt the U.S. technological advantage."⁶⁹ Two systems, which many of the third-world nations already possess, that may potentially give them a "very sophisticated and asymmetrical capability" against a more advanced opponent include weapons of mass destruction (WMD) and ballistic missiles.⁷⁰

Weapons of mass destruction are more prevalent today than ever before and the prognosis to reverse this trend does not look good. According to General Reimer, "at the turn of the twenty-first century, as many as eight developing countries could have nuclear weapons, up to thirty could have

chemical capabilities, ten could possess biological weapons capabilities and fifteen could be producing ballistic missiles.⁷¹ Clearly, "given adversaries that view WMD weapons as a means of compensating for U.S. advantages in other capabilities, the future operating environment is likely to include many contaminated by nuclear, biological, or chemical agents."⁷²

Ballistic missiles also give a force fighting from a position of disadvantage the potential to negate certain technological strengths of an opponent. Deployment infrastructures, such as ports and airfields, are especially vulnerable to interdiction by long-range ballistic and cruise missiles. As long as power projection forces are required to transit through these facilities in a "port-to-port" deployment methodology into theater they are vulnerable to interdiction by ballistic and cruise missiles. During the AAN 1998 Spring Wargame, "Red Strategy explicitly called for an ambitious campaign of deployment denial. Red attacked the entire infrastructure, including ports, airfields, OCONUS staging bases, lift assets, fuel supplies, and the information system and software used to control deployment. The small delays created by this campaign had significant operational consequences favorable to the enemy."⁷³

The very real threat posed by weapons of mass destruction and ballistic missiles could not only jeopardize the ability of the U.S. to project combat power into theater quickly and decisively, but also could negatively effect coalition cohesion on the future battlefield.⁷⁴ Future U.S. forces, such as Strike Force, must be protected from the threat posed by WMD weapons and ballistic missiles. Additionally, they must not be dependent on a port or specific airfield for

deployment, but rather be able to deploy from one point to another point without flowing through vulnerable transportation nodes.

A critical component to any indirect fire system is the ability to accurately locate targets. Reasonably then target acquisition technology is expected to continue to evolve at a dramatic pace. In fact, the proliferation of information and sensor technologies will increase so rapidly that "by 2025, most of the GIE [global information environment] infrastructure will be commercially owned and operated from space platforms. As a result, commercial and third-party intelligence, surveillance, and reconnaissance (ISR) will be available to virtually anyone, including adversaries."⁷⁵ This unique dilemma suggests that the future U.S. force be as "stealthy" as possible,

In summary, while unable to predict the detailed evolution of potential threats, certain trends can be identified which help paint the vision of the environment in which Strike Force may have to operate. First, military operations in complex terrain, especially in urban environments will likely become the order of the day and cannot be avoided. Second, the use of WMD weapons and ballistic missiles will make the deployment infrastructure vulnerable to interdiction. Forces that are capable of deploying "point-to-point", as opposed from "port-to-port" will offset this vulnerability. Finally, the future accessibility to high-tech ISR assets will place new importance on "stealthy" forces.

V. Wheeled Combat System Capabilities

Having identified Strike Force's operational environment, it is time to analyze the capabilities that wheeled and tracked combat systems potentially offer. The aim of this chapter is to explore the inherent advantages and disadvantages of a wheeled Strike Force vehicle. As already highlighted the key to Strike Force is finding the optimal balance between being light enough to deploy rapidly and heavy enough to carry sufficient combat power to accomplish the mission. Four vehicle characteristics that are closely tied to finding this balance are: strategic and operational transportability; tactical mobility; supportability; and survivability. Analyzing each of these characteristics for both types of vehicle offers a useful structure to discern insights to help answer the original research question.

In order to help isolate these characteristics the weight of each type of vehicle will assumed to be the same.

Strategic and Operational Transportability

The greatest advantage of wheeled vehicles over tracked vehicles of comparable weight is their superior transportability. This quality, which is defined as the inherent capability of a system to be efficiently moved by required transportation assets using the highway, rail, marine, or air modes of transport, is the keystone of strategic and operational mobility.⁷⁶ It is a system's transportability that allows it to be deployed into a theater or moved within an existing theater rapidly, a necessary prerequisite for strategic preclusion.

As highlighted in a 1985 TRADOC Mobility Report "the one key feature in surface transportability is the ability of wheeled vehicles to self-deploy over the road network within a theater."⁷⁷ Unlike many tracked vehicles, wheeled systems do not have to be transported on trucks on most U.S. roadways. Because wheels do less damage to roads than tracks, they are less hindered by national and international surface transport restrictions. This fact is especially important since every Army installation is not conveniently situated adjacent to a viable Port of Embarkation (POE), and not all conflicts can be expected to occur next to a Port of Debarkation (POD). Consequently, surface transportability is an important advantage for wheeled vehicles.

The greater speed that can be attained in wheeled systems operating on roadways as opposed to tracked systems is another important advantage tied to transportability. "Wheeled vehicles inherently attain faster road speeds and therefore, offer the best solution where unrestricted mobility is not the primary mission driver and on-road usage exceeds off-road usage."⁷⁸ Nearly unrestricted access to roadways, coupled with higher attainable speeds on these roads, equates to wheeled vehicles enjoying a better intra-theater self deployment capability than comparable tracked vehicles.

Tactical Mobility

Good tactical mobility will be essential for Strike Force vehicles to operate at the increased tempo expected on the future battlefield and will be a primary driver in analyzing the Strike Force combat system. Mobility as defined by the

TRADOC Wheeled-Versus-Track Study is “the ability to move freely and rapidly over the terrain of interest to accomplish varied combat objectives.”⁷⁹ Many factors impact on a vehicle’s tactical mobility. Several of the more important of these include the system’s ability to maneuver over obstacles, its tractive ability over various soils, and its ability to negotiate varied vegetation and conditions.⁸⁰

Wheeled vehicles inherently do not cross obstacles or negotiate ditches and gaps as well as tracked vehicles. According to Army research, “for vertical walls and linear features, such as dikes in rice fields or rubble from demolished buildings, wheeled vehicles are competitive with tracked vehicles up to the height of the wheeled vehicles vertical ground clearance. Above this height, problems are encountered with the bottom of the wheeled vehicle grounding on the obstruction.”⁸¹ Steep approaches to ditches also can present a problem for wheeled vehicles.⁸²

A vehicle’s tractive ability or ability to develop thrust in the intended direction is directly related to how much pressure it exerts on the ground. Ground pressure is a measure of the vehicle’s weight being supported by the surfaces of the vehicle in contact with the ground. For tracked systems with large surface areas supporting the weight of the vehicle the ground pressure is low allowing them to traverse softer surfaces. Wheeled systems have a much smaller contact surface and therefore, inherently have a higher ground pressure. This results in softer surfaces not being able to support a wheeled vehicle as opposed to a tracked vehicle of equal weight.

It should be of no surprise then that Army studies have concluded that wheeled and tracked vehicles enjoy comparable mobility on hard surfaces or when the wheeled vehicle's weight is ten tons or less.⁸³ However, on very soft, wet ground, such as loose sand or marshy terrain, wheeled systems just cannot keep up with its tracked counterpart.⁸⁴

Snow also presents a problem for wheeled vehicles. In shallow accumulations, wheeled vehicles can push the snow out of the way and continue to move. Once the snow reaches a depth of approximately one third of the tire diameter, wheeled vehicles become bogged down.⁸⁵ Another disadvantage is the fact that slippage in snow or soft soil of vehicles of equal weight will occur earlier in a wheeled than in a tracked vehicle.⁸⁶

Steering and stopping capabilities also impact on tactical mobility. Because they do not pivot steer like tracked vehicles, wheeled systems cannot turn around in confined spaces such as in a narrow alley or street.⁸⁷ Neither can they turn as sharply as a tracked system, but this can be as much a hindrance as a benefit. "Wheeled vehicles will normally just plow forward in the dirt when they are turned too fast whereas a tracked vehicle may turn over."⁸⁸

Overall, wheeled systems are less mobile over five to fifteen percent of the terrain than tracked systems, but technology is helping them close the gap.⁸⁹ Rubber belts or band tracks, central tire inflation and deflation, tire chains, and wheel slip sensing systems all are designed to help wheeled systems more closely approach the off-road mobility of tracked vehicles in very soft terrain.⁹⁰

Supportability

As mentioned earlier an important consideration in designing Strike Force is making the organization self sustaining for up to fourteen days. The primary combat system employed by Strike Force will play a very important part in making this possible. As indicated by AAN researchers, future battles are expected to be "short, decisive, and conclusive, thereby reducing the time available for replenishment."⁹¹ Logically, the Strike Force's combat platform must possess a high degree of supportability. While supportability is dependent on many factors, fuel usage and vehicle reliability are especially critical in shrinking the logistic tail to the theater of operations.⁹²

Wheeled vehicles enjoy better fuel efficiency due to less inherent friction than tracked counterparts. Smoother suspensions, reduced rolling resistance, and more efficient running gears all add up to considerable advantage in fuel consumption for wheeled vehicles.⁹³ "This advantage is in the order of fifty percent for comparable vehicles in the ten to twenty ton gross vehicle weight class."⁹⁴ In a combat vehicle, lower fuel consumption translates into longer operating ranges. "The ability to operate over longer ranges is particularly important in view of the lower density of forces in future theaters of operations and the attendant dispersion of combat units."⁹⁵

In addition to better fuel economy, wheeled vehicles also enjoy a higher degree of reliability and require less maintenance than tracked vehicles.⁹⁶ With lower vibration and vehicle-generated noise, there is "less damage to mechanical/hydraulic and electrical components in wheeled vehicles."⁹⁷ One

disadvantage to a wheeled vehicle's reliability is that to compete with the mobility of a tracked vehicle, a wheeled system must have more than four wheels. With each set of wheels there are more opportunities for key components to break.⁹⁸

Survivability

Armored vehicle survivability is a function of several fundamental objectives: avoid detection; if detected, avoid being hit; and if hit, avoid crew and vehicle destruction.⁹⁹ Using these three objectives as a framework, several key survivability insights for wheeled vehicles become evident.

Their lower acoustic signature and potential for increased crew endurance offer advantages for wheeled systems in detection avoidance. While thermal and radar signatures are nearly equal for comparable wheeled and tracked vehicles, "wheels provide a reduced noise signature while moving, primarily due to less vibration and metal to metal contact on running gear."¹⁰⁰ Additionally the "lower vibrations and vehicle-generated noise in wheeled vehicles" increases crew endurance potentially resulting in more alert operators.¹⁰¹

If detected, a wheeled system may not be able to avoid being hit as well as a tracked vehicle might. The first reason for this has to do with dash speed. While both systems have similar sprint capabilities on hard surfaces, on soft soils the wheels are considerably disadvantaged.¹⁰² The second factor that hinders a wheeled system's hit avoidance capability stems from its inherent disadvantage as a larger caliber multi-round gun platform. As a gun platform firing from a stationary position, wheeled and tracked vehicles are comparable at larger

calibers for the first round only. If a second round is fired before the wheeled vehicle stops bouncing, the probability of the round hitting the target decreases.¹⁰³

With respect to avoiding destruction, wheeled systems have both advantages and disadvantages. If hit by a mine a wheeled vehicle actually has the advantage over tracks in avoiding destruction. "Multi-wheeled armored vehicles are less vulnerable to mines than tracked vehicles, which are completely immobilized if one of their tracks is broken. Conversely multi-wheeled vehicles can still be driven at speed after one of their wheels is blown off and can limp away after two wheels are gone."¹⁰⁴ Admittedly, however, a track is more durable and can conceivably absorb a larger explosion than a wheel could. Additionally, a wheeled system tends to be more vulnerable to small arms fire, grenade, and artillery fragments, "due to the inherent weakness of wheeled suspension designs, components, and tires."¹⁰⁵

This analysis seems to indicate that the overall advantages for a wheeled Strike Force combat system include better operational and strategic transportability and better supportability. While the disadvantages include reduced tactical mobility. With respect to survivability, wheeled systems have both advantages and disadvantages that are too close to call without first analyzing in more detail the capabilities of a tracked system.

VI. Tracked Combat System Capabilities

Having analyzed the potential advantages and disadvantages of a wheeled Strike Force combat system, this chapter turns its attention to a tracked system. Again the four key vehicle characteristics of strategic and operational transportability; tactical mobility; supportability; and survivability serve as the framework for this analysis.

Strategic and Operational Transportability

If the greatest advantage of wheeled vehicles is superior transportability, it stands to reason that this feature will in turn be the primary disadvantage to a tracked system. This reduction in transportability as compared to a similar wheeled vehicle, results in a force inherently less capable to be moved intraCONUS, intertheater, and intratheater to support a military operation. Several factors related to highway restrictions and attainable road speeds account for this disadvantage of tracked systems.

While comparable tracked and wheel vehicles in the twenty to thirty ton weight range possess virtually indistinguishable transportability characteristics via rail, sea, and air, this is not the case for movement on highways. According to the U.S. Military Traffic Management Command because the U.S. and several other nations restrict movement of tracked vehicles on these routes for travel over certain distances, tracked vehicles will likely be carried on prime movers over public routes.¹⁰⁶ Not only does this add additional time to stage, load, brace, and tie down the tracked vehicles, but it also means that the prime mover

combination must be included when highway transport restrictions are considered. This restriction also increases the likelihood that the load will not be able to be transported from point to point, since route or loading/unloading restrictions may dictate that getting the system "close enough" will have to suffice.

Tracked vehicles are also restricted in their transportability because they cannot attain road speeds as fast as wheeled vehicles. Besides nationally imposed speed limits for tracks, as each track pad strikes the hard road surface it imparts a vibration to the vehicle that is directly proportional to the vehicles speed. This vibration not only forces the vehicle to slow down; it also generates "unique equipment isolation problems for onboard equipment" and increases crew fatigue.¹⁰⁷

A note should be made of one advantage a tracked system may have via air transport. As a result of reduced suspension and wheel turning clearance and the absence of multiple transfer cases and drive shafts that are integral to a multi-wheeled vehicles, tracked vehicles by design are inherently more compact than wheels.¹⁰⁸ The net result of this is that for a given overall size, a tracked vehicle will offer greater payload cube which translates into better air transportability on size and not weight constrained airframes.¹⁰⁹

Tactical Mobility

The single biggest advantage of tracked vehicles over their wheeled counterparts is the ability to move over most difficult and soft terrain. Tactical

mobility will be essential for the Strike Force and will depend in part on the combat system's ability to maneuver over obstacles, its tractive ability over various soils, and its ability to negotiate varied vegetation and conditions.¹¹⁰

Tracked vehicles are able to cross obstacles and negotiate ditches and gaps better than wheeled systems. With a self-bridging capability arising from the continuous track on each side of the vehicle, they are able to traverse vertical walls higher than their ground clearance unlike wheeled systems. "Additionally, tracked vehicles offer superior soft-soil mobility to propel the vehicle over the obstacle when part of the tracks are off the ground."¹¹¹

Tracked vehicles, which essentially carry their own road, exert a much lower ground pressure on the terrain surface than a comparable wheeled vehicle allowing them to traverse very soft and wet terrain without sinking. With the ability to retain their mobility in snow up to approximately three feet, deep snow is a "mission profile that is almost totally reserved for special purpose tracked vehicles."¹¹² The gripping effect with the ground and adhesive friction that cleats give a track further enhances its off-road mobility.

Good steering and stopping capabilities also increase the maneuverability of tracked vehicles. Tracks can make tighter turns than wheels due to their skid steering capability and generally require a lower soil strength differential in turning situations.¹¹³ This maintains a track's ability to turn even in very slippery or soft conditions. With respect to stopping, TRADOC's Mobility Analysis indicates that tracks stop quicker at speeds above twenty-five miles per hour.¹¹⁴

Supportability

As mentioned earlier wheeled systems definitely have the advantage over tracked systems in supportability. Both fuel usage and vehicle reliability play heavily on a tracked systems supportability.

The increased metal to metal contact and resulting friction in tracks makes the engine work harder resulting in higher fuel consumption. In fact, in a 1994 *International Defense Review Special Report*, Mr. R.M. Ogorkiewicz, a noted international expert on tank development and author of over 400 articles and several books on the subject, concluded that on average a tracked vehicle consumes roughly twice as much fuel as a comparable wheeled system. While future fuels may reduce this margin, the physics of track mobility will remain the same. For this reason, tracks will most likely always be less fuel-efficient than their counterparts.

Survivability

Similar to analyzing wheeled vehicle survivability, this section focuses on the tracked system's ability to: avoid detection; if detected, avoid being hit; and if hit, avoid crew and vehicle destruction.¹¹⁵

When it comes to avoiding detection, tracks have both advantages and disadvantages inherent to the system. The biggest advantage for tracks in not being detected stems from their compactness. This compactness and the ability to have a lower ground clearance equate to a marginally lower silhouette. However, the fact still remains that tanks have higher acoustic signatures than

comparable wheeled vehicles. This noise, coupled with vehicle vibrations, can also negatively impact the ability of the crew to remain alert to an enemy presence.

If detected, a tracked vehicle may be able to avoid being hit better than a wheeled system. The first reason for this has to do with their superior dash speed especially in soft soil. Being a superior weapon platform for larger guns also helps the track to avoid being hit. When the vehicle is moving the "gun stabilization system only has to counteract suspension movements. In the wheeled vehicle, the stabilization system has to overcome tire-flex also."¹¹⁶

Similar to the wheeled system, with respect to avoiding destruction, tracked vehicles also have advantages and disadvantages. If hit by a mine a tracked vehicle risks becoming completely immobilized if it breaks a track; however, these same tracks provide the vehicle and crew better protection against small arms attacks, indirect fire, and fragmentation from mine explosions.¹¹⁷

Overall the key advantage for a tracked Strike Force combat system would likely be its better tactical mobility over a wheeled counterpart, while the disadvantages would include reduced operational and strategic transportability and overall supportability. With respect to survivability, tracks, like wheeled systems have both advantages and disadvantages. The former is better suited to survive by avoiding hits and being able to prevent crew and vehicle destruction. The latter would likely depend on avoiding detection in order to survive while remaining vulnerable to fragmentation damage.

VII. Analysis and Evaluation

So far this paper has focused on defining what the Strike Force is intended to be and the operational environment in which it might operate. Next the potential advantages and disadvantages of employing wheeled and tracked combat systems under this concept were analyzed. Now it is time to return to analysts' earlier concern and answer the question of which of these combat systems is best suited for the Strike Force. As a matter of reflection, the purpose of the Strike Force, besides serving as an experimentation force, is to give the U.S. a medium weight contingency unit capable of deploying faster than the Army's heavy forces, but having more combat power than current light forces. As highlighted *in Army Vision 2010* the Strike Force, as part of the Army, will do this using an identified set of patterns of operation. The better combat system for the Strike Force will be the one that best allows it to execute these patterns which include projecting the force, protecting the force, shaping the battlespace, conducting decisive operations, and sustaining the force.¹¹⁸ These five patterns of operation therefore serve as a logical set of evaluation criteria in determining the answer to the research question.

Project the Force

According to *Army Vision 2010*, Projecting the Force equates to strategic maneuver or deploying the force from CONUS into theater. "It initiates the process of creating an image in the mind of an adversary of an unstoppable force of unequaled competence."¹¹⁹ Several key concepts identified in *Army*

Vision 2010 with respect to projecting the force include rapid deployability and the ability to deploy directly into combat. Clearly, from the perspective of projecting the force, a wheeled combat system is better for the Strike Force than a tracked one. Wheeled systems are much more capable of self-deploying in theater and can attain faster road speeds than tracks.

Together these advantages mean that wheeled systems are better able to deploy from point to point as opposed from port to port. Making them less vulnerable to interdiction by enemy forces and better suited for allowing the Army to establish sufficient combat power in theater before the enemy has the ability to "set" his force to attack. As noted in Chapter III, AAN researchers have identified this ability to execute strategic preclusion as critical to the Army's future success.

Protect the Force

With respect to the patterns of operation, Protecting the Force is defined as the ability "to avoid detection – prevent acquisition – avert hits – and survive hits."¹²⁰ *Army Vision 2010* notes that the Army's ability to protect the force will ensure its freedom of action during deployment, maneuver, and engagement.¹²¹ Obviously the combat system used by an organization plays a key role in "protecting the force." With respect to this evaluation criterion, tracked vehicles slightly beat out their wheeled counterparts.

Wheeled systems could reasonably expect to better avoid detection than their tracked counterpart. This is primarily due to the wheeled vehicle's lower

acoustic signature and increased crew endurance as a result of lower inherent noise and vibration. On the other hand a tracked vehicle would likely be better suited to avoid being hit as a result of a quicker dash speed and superior multi-round gun platform characteristics. With respect to avoiding crew and vehicle destruction, earlier analysis indicates that while tracks do risk becoming immobilized in minefields they are less vulnerable to damage by fragmentation.

In the end, protecting the force slightly favors using a tracked vehicle as the Strike Force primary combat system. While each type of vehicle takes advantage of a different aspect of protection, tracks seem more capable of avoiding being hit once detected and of preventing crew and vehicle destruction if hit.

Shape the Battlespace

According to *Army Vision 2010*, “Shaping the Battlespace sets the conditions for success” and is directly linked with decisive operations.¹²² Key identifying concepts for shaping the battlefield include dominating an expanded multidimensional battlespace, destroying key enemy capabilities, and influencing enemy perceptions.¹²³ While very close between wheeled and tracked systems, shaping the battlefield appears to slightly favor a tracked Strike Force combat system.

As discussed earlier tracked vehicles are better able to accommodate the recoil of large caliber gun systems and increase the probability of multiple round hits. This fact results from the gun stabilization system needing only to

overcome suspension movements in a tracked vehicle and not the undamped tire flexing inherent when a large caliber gun is fired from a wheeled platform. Obviously, this problem is not as critical with a missile as opposed to a gun. Nevertheless, the tracked system does have somewhat of an advantage in shaping the battlespace over a wheeled one. With respect to influencing the enemy's perceptions a judgement is not so easily made. On one hand, a wheeled system logically might be more politically acceptable in stability and support operations as tracks are often viewed as "instruments of oppression," while in offensive operations the deterrent value of tracked vehicles arriving in theatre cannot be overstated.

Decisive Operations

According to *Army Vision 2010* "operational maneuver...equates to decisive operations." This pattern of operation entails the ability to mass effects without massing forces and to conduct simultaneous, brief violent attacks in multiple directions.¹²⁴ In this way "decisive operations" appears to capture two key concepts. The first relates to operational transportability and the second corresponds to tactical mobility. Together this allows an organization to "attack – disengage – reorganize – and reattack."¹²⁵ Similar to "shaping the force," an evaluation of employing a wheeled and tracked vehicle with respect to decisive operations yields very close results but does slightly favor use of a tracked Strike Force vehicle.

The biggest advantage that wheeled vehicles enjoy with respect to decisive operations is that they inherently enjoy a higher level of operational transportability than do tracked vehicles even though in some cases a higher payload cube advantage rests with tracks. The reasons for this are largely the same as why wheeled vehicles are better for projecting the force. Namely, wheeled systems are much easier and quicker to move via surface transportation networks especially on roads.

Although faced with this disadvantage, overall “decisive operations” still favors using a tracked Strike Force vehicle. The reason for this encompasses the biggest advantage that tracked vehicles have over their wheeled counterparts, better tactical mobility. Although studies have concluded that tracks and wheels are equally mobile over roughly eighty-five percent of the world’s terrain, the fact remains that in soft soil and in deep snow that tracks are the only choice.

For a number of reasons, tracks also seem to be the logical choice for conducting decisive operations in urban and complex terrain. Several factors account for this. First, the self-bridging capability of tracked vehicles equates to a better obstacle and gap crossing capability and helps tracked systems crawl over roadblocks that are higher than the vehicle’s ground clearance. Also, the skid steering capability of tracked vehicles enables them to turn around in confined spaces such as alleys more easily than wheels can. The bottom line with respect to decisive operations is that while wheeled vehicles have better

operational transportability, the superior tactical mobility of tracked vehicles and potentially better ability to operate in urban terrain gives them a slight edge.

Sustain the Force

As indicated in *Army Vision 2010*, “smaller fighting elements with easily maintainable equipment, made of more durable materials which share repair-part commonality among component-specific equipment and equipment in other components, will significantly reduce the volume and complexity of the resupply system.”¹²⁶ In this light a wheeled Strike Force vehicle is greatly favored over a tracked system.

One of the key characteristics that force designers intend for the Strike Force is to make it self-supporting for up to two weeks. To realize this goal the combat system of the organization must be as fuel-efficient as possible. As already noted, studies have indicated that the lower inherent friction of wheeled systems over tracked ones directly corresponds to a more fuel efficient vehicle. This better fuel economy coupled with the higher reliability of wheeled systems equates to a combat system that is more sustainable than a tracked counterpart.

VIII. Conclusion

| Evaluation Criteria | Would a wheeled Strike Force combat system be better than a tracked one? | Remarks |
|----------------------------|---|-----------------------------------|
| Project the Force | Yes | Wheeled vehicle greatly favored. |
| Protect the Force | No | Tracked vehicle slightly favored. |
| Shape the Battlespace | No | Tracked vehicle slightly favored. |
| Decisive Operations | No | Tracked vehicle slightly favored. |
| Sustain the Force | Yes | Wheeled vehicle greatly favored. |

In conclusion, a wheeled Strike Force combat system presents a definite advantage with respect to projecting and sustaining the force, while a tracked vehicle holds only a slight advantage in protecting the force, shaping the battlespace, and in conducting decisive operations. Looking back at the purpose of Strike Force which is to be a future contingency unit able to deploy within ninety-six hours and have enough combat power to "hold its own against a lethal enemy force" and keeping in mind the value of being able to deploy quickly enough to facilitate strategic preclusion, the criteria of projecting the force is paramount to Strike Force success.¹²⁷ AAN analysts who highlighted the need to be able to project power quickly as "one of the most important insights of the AAN Project" support this assertion.¹²⁸

Linked closely to the concept of force projection is the ability to sustain the force. A unit that is more sustainable has a shorter logistics footprint and therefore enjoys a longer operating range; a feature that will facilitate dispersed operations expected on the future battlefield. A high level of sustainability also

makes a force less vulnerable to deployment interdiction campaigns and less vulnerable to an enemy coercion strategy that targets friendly lines of communication.

Due to the importance of projecting and sustaining the force, it appears that analysts who expressed concern that a wheeled combat system for the Strike Force may be better suited for the organization's intended purpose and expected operational environment were correct. Although very close, a wheeled combat system does seem better suited for the Strike Force. In both projecting the force and sustaining the force, a wheeled vehicle is greatly favored for the organization while only slightly disadvantaged in the remaining three criteria. In terms of *Army Vision 2010*, a wheeled vehicle is the logical choice for the Strike Force primary combat system. As of the publication of this monograph, this finding is somewhat troubling due to the decision to task organize the Strike Force from current Army organizations none of which have wheeled combat systems.

The definite advantage that track vehicles have with respect to tactical mobility and the very close results of this analysis present an implication that warrants future study. It seems feasible that a band track could be developed, similar to that discussed in earlier chapters that could be mounted over the tires of the Strike Force vehicle if the organization was deployed to a region of the world that would best suit a tracked vehicle. In this way, the Strike Force would have the permanent advantages of a wheeled system, but have the flexibility to use tracks if a specific mission required better tactical mobility.

ENDNOTES

¹ Giulio Douhet, *The Command of the Air*, Ed. Richard H. Kohn and Joseph P. Harahan, trans. Dino Ferrari, (Washington, DC: Office of Air Force History, 1983), pp. 145-146.

² Dennis Steele, The Army XXI Heavy Division – First Blueprint of the Future Army, *Army*, Vol. 48, No. 7, July 1998, p. 35.

³ Sean D. Naylor, "Strike Force Struck Down ... For Now", *Army Times*, (4 January 1999), p. 7.

⁴ Sean D. Naylor, "Reimer Defends Strike Force Headquarters", *Army Times*, (18 January 1999), p. 14.

⁵ John Gordan IV and Peter A. Wilson, *The Case for Army XXI "Medium Weight" Aero-Motorized Divisions: A Pathway to the Army of 2020*, (The RAND Corporation, 1998), pp. 4-5.

⁶ Ibid., p. 5.

⁷ Ibid., p. 6.

⁸ Naylor, "Strike Force Struck Down ... For Now", p. 7.

⁹ Naylor, "Reimer Defends Strike Force Headquarters", p. 14.

¹⁰ Dennis J. Reimer, *Army Vision 2010*, (Washington, D.C.: U.S. Department of the Army, 1996), p. 10.

¹¹ The patterns of operations align closely with the core functions of a military force's physical capabilities as outline in the April 1998 Draft FM 100-5. Although under revision again, the draft manual identified in Chapter Two that "a force's physical capability comes from its ability to sense the enemy, itself, and the environment; strike an opponent decisively; move freely in the area of operations; control actors, actions, and events; shield itself from the attacks of an opponent; and sustain itself." United States Department of the Army, *Revised Final Draft Field Manual 100-5, Operations*. (Washington, DC: U.S. Government Printing Office, 6 April 1998), pp. 2-8 – 2-9.

¹² Naylor, "Reimer Defends Strike Force Headquarters", Ibid., p. 14.

¹³ U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. ii.

¹⁴ Sean D. Naylor, "The Future Army Debate Rages On – 2d Armored Cavalry a Trial Strike Force", *Army Times*, (20 April 1998), p. 12.

¹⁵ Ibid., p. 10.

¹⁶ Sean D. Naylor, "Strike Force Struck Down ... For Now", *Army Times*, (4 January 1999), p. 7.

¹⁷ Dennis Steele, The Army XXI Heavy Division – First Blueprint of the Future Army, *Army*, Vol. 48, No. 7, July 1998, p. 35.

¹⁸ COL Wallace P. Franz, "Airmechanization: The Next Generation", *Military Review*, U.S. Army Command and General Staff College, Vol. LXXII, No. 2, February 1992, p. 60. Simpkin, who is credited for coining the term "airmechanized" used the phrase to signify the intimate cooperation of armor and helicopters at tactical and lower operational levels on future battlefields. His ideas are captured in detail in Brigadier Richard E. Simpkin, "An Airmechanized Force for the 90s." *ARMOR* (July-August 1981): 54.

¹⁹ Naylor, "The Future Army Debate Rages On – 2d Armored Cavalry a Trial Strike Force", Ibid., p. 13.

²⁰ Sean D. Naylor, "Strike Concept Could Spread", *Army Times*, (11 May 1998), p. 16.

²¹ Naylor, "The Future Army Debate Rages On – 2d Armored Cavalry a Trial Strike Force", Ibid., p. 13.

²² LTC Billy J. Jordan and LTC Mark J. Reardon, "Restructuring the Division: An Operational and Organizational Approach", *Military Review*, U.S. Army Command and General Staff College, Vol. LXXVII, No. 3, May-June 1998, p. 24.

²³ U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. 10.

²⁴ Ibid., p. 10.

²⁵ Ibid., p. 5.

²⁶ Ibid., pp. 5-6.

²⁷ Naylor, "Reimer Defends Strike Force Headquarters", Ibid., p. 14.

²⁸ Jason Sherman, "Bulking Down," *Armed Forces Journal International*, Vol. 136, No. 3, July 1998, p. 34.

²⁹ Carl von Clausewitz, *On War*, edited and translated by Michael Howard and Peter Paret, (Princeton: Princeton University Press, 1989), p. 75.

³⁰ United States Department of the Army. Office of the Chief of Staff of the Army, *America's Army of the 21st Century: Force XXI*, Washington, D.C.: U.S. Department of the Army, 1995, p. 22.

³¹ U.S. Army Training and Doctrine Command. *TRADOC Pamphlet 525-5, Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century*, (Fort Monroe, VA: U.S. Army Training & Doctrine Command, 1994), p. 3-1.

³² United States Department of the Army, *Revised Final Draft Field Manual 100-5, Operations*, Ibid., p. ix.

³³ TRADOC Pamphlet 525-5, p. 3-1.

³⁴ Vector Research Incorporated, *The 21st Century Army: Roles, Missions, and Functions in an Age of Information and Uncertainty*, (Ann Arbor, MI: Vector Research Incorporated, 1996), p. 8.

³⁵ TRADOC Pamphlet 525-5, p. 3-2

³⁶ Revised Final Draft Field Manual 100-5, pp. 1-15 – 1-18.

³⁷ Dennis J. Reimer, *Army Vision 2010*, (Washington, D.C.: U.S. Department of the Army, 1996), p. 12.

³⁸ U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. 12.

³⁹ Douglas V. Johnson, *AY97 Compendium: Army After Next Project*, (Carlisle Barracks, PA: Strategic Studies Institute, April, 1998), p. viii

⁴⁰ COL Robert B. Killebrew, "The Army After Next: TRADOC's Crystal Ball Eyes The Service's Shape Beyond Force XXI", *Armed Forces Journal International*, Vol. 134, No. 3, October 1996, p. 36.

⁴¹ U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. iv.

⁴² BG Edward T. Buckley Jr., LTC Henry G. Franke III, and A. Fenner Milton, "Army After Next Technology: Forging Possibilities into Reality", *Military Review*, U.S. Army Command and General Staff College, Vol. LXXVIII, No. 2, March/April 1998, p. 4.

⁴³ U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. 3.

⁴⁴ Ibid., pp. 5-6.

⁴⁵ Ibid., p. 6.

⁴⁶ Ibid., p. 6.

⁴⁷ Ibid., p. B-3.

⁴⁸ Ibid., p. 14.

⁴⁹ Ibid., p. B-3.

⁵⁰ Killebrew, Ibid., p. 45.

⁵¹ Buckley, Ibid., p. 6.

⁵² U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. 9.

⁵³ Buckley, Ibid., p. 5.

⁵⁴ Killebrew, Ibid., p. 45.

⁵⁵ Killebrew, Ibid., p. 44.

⁵⁶ Generalfeldmarschall Graf Helmuth von Moltke, *Augsgewaehlte Werke I. Feldheer und Kriegsmeister*, (Berlin, 1925), p. 74.

⁵⁷ Douglas A. MacGregor, *Land Warfare Paper No. 20: Setting the Terms of Future Battle for Force XXI*. (Arlington, VA: Association of the United States Army, 1995), p. 12.

⁵⁸ von Clausewitz, *Ibid.*, p. 77.

⁵⁹ GEN Henry H. Shelton, "Operationalizing Joint Vision 2010", *Military Review*, U.S. Army Command and General Staff College, Vol. LXXVIII, No. 3, May/June 1998, p. 81.

⁶⁰ U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. 1.

⁶¹ *Ibid.*, p. 2.

⁶² LTC Lester W. Grau, "Bashing the Laser Range Finder With a Rock", *Military Review*, U.S. Army Command and General Staff College, Vol. LXXVII, No. 3, May/June 1997, p. 43.

⁶³ For a recent discussion of the challenges of conducting military operations in urban terrain see Russell W. Glenn, Randall Steeb, John M. Matsumura, Sean Edwards, Robert Everson, Scott Gerwehr, and John Gordon, *Denying the Widow-Maker*, (The RAND Corporation, 1998), p. 27.

⁶⁴ U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. 19.

⁶⁵ For a very futuristic think-piece on armored warfare of tomorrow see Ralph Peters, "The Future of Armored Warfare", *Parameters*, U.S. Army War College, Vol. XXVII, No. 3, Autumn 1997, p. 53.

⁶⁶ The total Russian strength in Grozny included 230 tanks, 454 BMPs, and 388 artillery tubes. The Chechen forces had fifty tanks, one hundred armored vehicles, and sixty artillery tubes. The Chechen forces used tactics such as letting armored columns into the city, sealing it off, and then methodically annihilating the column through coordinated ambushes. Another tactic used was to shoot Russian soldiers in the legs and then shoot-to-kill any soldiers that came to his aid. For a more detailed account of the Russian experience in Grozny see: Glenn, *Ibid.*, pp. 49-59.

⁶⁷ Glenn, *Ibid.*, p. 4.

⁶⁸ U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. 19.

⁶⁹ Grau, *Ibid.*, p. 43.

⁷⁰ Robert H. Williams, "Precision Weaponry, Speed, Dominance Mark Army Plan", *National Defense*, Vol. LXXXI, No. 525, February 1997, p. 31.

⁷¹ General Dennis J. Reimer, "Challenge and Change: A Legacy for the Future", *Military Review*, U.S. Army Command and General Staff College, Vol. LXXVII, No. 4, July/August 1997, p. 109.

⁷² U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. 15.

⁷³ *Ibid.*, p. 15.

⁷⁴ *Ibid.*, p. 15.

⁷⁵ *Ibid.*, p. 16.

⁷⁶ Military Traffic Management Command Transportation Command Transportation Engineering Agency (MTMCTEA) Reference Guide 98-70-1, *Transportability and Deployability for Better Strategic Mobility*, Newport News Virginia, April 1997, p. 9.

⁷⁷ U.S. Army Training and Doctrine Command. *TRADOC Final Report ACN 070846, Wheeled Versus Tracked Vehicle Study*, (Fort Monroe, VA: U.S. Army Training & Doctrine Command, 1985), p. 1-64.

⁷⁸ Paul Hornback, "The Wheel Versus Track Dilemma", *ARMOR*, HQDA PB-17-98-2 (March-April 1998), p. 33.

⁷⁹ *Ibid.*, p. 33.

⁸⁰ *Ibid.*, p. 33.

⁸¹ TRADOC Final Report ACN 070846, Ibid., p. 1-48.

⁸² Ibid., p. 1-48.

⁸³ Ibid., p. 1-44.

⁸⁴ R.M. Ogorkiewicz, "World-wide Trends in the Development of Armored Fighting Vehicles", *International Defense Review Special Report*, (Alexandria, VA: Jane's Information Group Inc, 1994), p. 6.

⁸⁵ TRADOC Final Report ACN 070846, Ibid., p. 1-46.

⁸⁶ Jurgen Erbe, "Wheels or Tracks?", *Military Technology*, Vol. 18, No. 7, July 1994, p. 11.

⁸⁷ R.M. Ogorkiewicz, "Armored Reconnaissance Vehicles: Finding the Right Capability Mix", *International Defense Review Special Report*, (Alexandria, VA: Jane's Information Group Inc, 1995), p. 22.

⁸⁸ TRADOC Final Report ACN 070846, Ibid., p. 1-50.

⁸⁹ Ibid., p. 1-54.

⁹⁰ STAR 21: *Strategic Technologies for the Army of the Twenty-First Century*. (Washington, D.C.: National Academy Press, 1992), pp. 40-41.

⁹¹ U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. B-5.

⁹² Hornback, Ibid., p. 34.

⁹³ Ibid., p. 34.

⁹⁴ TRADOC Final Report ACN 070846, Ibid., p. 1-72.

⁹⁵ R.M. Ogorkiewicz, "Armored Reconnaissance Vehicles: Finding the Right Capability Mix", *International Defense Review Special Report*, Ibid., p. 20.

⁹⁶ R.M. Ogorkiewicz, "World-wide Trends in the Development of Armored Fighting Vehicles", *International Defense Review Special Report*, Ibid., p. 4.

⁹⁷ Erbe, Ibid., p. 12.

⁹⁸ Eric H. Biass, "On the Move, Smoothly", *Armada International*, Vol. 20, No. 2, April/May 1996, p. 32. The author states that "the more axles a vehicle has, the more opportunities there are for play to develop and add up in the numerous universal joints and differentials, and the more engine shocks are induced by the driver's right foot with abrupt power-ons and power-offs through a direct transmission, the more the play and backlash will further spiral up."

⁹⁹ STAR 21: *Strategic Technologies for the Army of the Twenty-First Century*. Ibid., p. 43.

¹⁰⁰ Hornback, Ibid., p. 34.

¹⁰¹ Erbe, Ibid., p. 13.

¹⁰² TRADOC Final Report ACN 070846, Ibid., p. 1-50.

¹⁰³ Ibid., p. 1-68. "This is due to undamped tire flexing under the recoil of the gun and is intrinsic with wheeled vehicle designs. The problem can be reduced by going to a soft recoil or low velocity gun. As a missile platform, wheeled and tracked vehicles are comparable when firing from rest. When firing on the move, the guidance technology employed in the missile is the determinant of which vehicle is the superior platform."

¹⁰⁴ R.M. Ogorkiewicz, "Armored Reconnaissance Vehicles: Finding the Right Capability Mix", *International Defense Review Special Report*, Ibid., p. 24.

¹⁰⁵ Hornback, Ibid., p. 33.

¹⁰⁶ Military Traffic Management Command Transportation Command Transportation Engineering Agency (MTMCTEA) Reference Guide 98-70-1, *Transportability and Deployability for Better Strategic Mobility*, Newport News Virginia, April 1997, p. 62.

¹⁰⁷ TRADOC Final Report ACN 070846, Ibid., p. 1-62.

¹⁰⁸ Hornback, Ibid., p. 33.

¹⁰⁹ TRADOC Final Report ACN 070846, Ibid., p. 1-62.

¹¹⁰ Ibid., p. 33.

¹¹¹ Ibid., p. 1-48

¹¹² Ibid., p. 1-46.

¹¹³ Ibid., p. 1-50.

¹¹⁴ Ibid., p. 1-50. The TRADOC Mobility Analysis attributes the track's ability to stop faster at speeds above twenty-five miles per hour to the mechanically different way that tracks apply their brakes than wheels.

¹¹⁵ STAR 21: *Strategic Technologies for the Army of the Twenty-First Century*. Ibid., p. 43.

¹¹⁶ TRADOC Final Report ACN 070846, Ibid., p. 1-68.

¹¹⁷ STAR 21: *Strategic Technologies for the Army of the Twenty-First Century*. Ibid., p. 39.

¹¹⁸ Reimer, *Army Vision 2010*, Ibid., p. 10.

¹¹⁹ Ibid., p. 11.

¹²⁰ Ibid., p. 14.

¹²¹ Ibid., p. 14.

¹²² Ibid., p. 13.

¹²³ Ibid., p. 13.

¹²⁴ Ibid., p. 12.

¹²⁵ Ibid., p. 12.

¹²⁶ Ibid., p. 15.

¹²⁷ Naylor, "The Future Army Debate Rages On – 2d Armored Cavalry a Trial Strike Force", Ibid., p. 10.

¹²⁸ U.S. Army Training and Doctrine Command, *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army*. (Washington, D.C.: U.S. Department of the Army, December 1998), p. 3.

BIBLIOGRAPHY

Books

Bellamy, Christopher. *The Evolution of Modern Land Warfare: Theory and Practice*. London: Routledge, 1990.

Beniger, James R. *The Control Revolution: Technological and Economic Origins of the Information Society*. Cambridge, MA: Harvard University Press, 1986.

Clausewitz, Carl von. *On War*. Ed. and Translated by Michael Howard and Peter Paret, with an introduction by Michael Howard. Princeton, NJ: Princeton University Press, 1989.

Cohen, Eliot A. and John Gooch. *Military Misfortunes: The Anatomy of Failure in War*. New York, NY: The Free Press, 1990.

Douhet, Giulio. *The Command of the Air*. Ed. Richard H. Kohn and Joseph P. Harahan. Trans. Dino Ferrari. Washington, D.C.: Office of Air Force History, 1983.

Dunnigan, J.F. and Macedonia, R.M. *Getting It Right: American Military Reforms After Vietnam to the Persian Gulf and Beyond*. New York: William Morrow and Company, Inc., 1993.

Fuller, John Frederick Charles. *The Foundations of the Science of War*. London: Hutchison & CO. LTD., 1926; a military classic reprint, Fort Leavenworth, KS: U.S. Army Command and General Staff College Press, 1993.

Glenn, Russell W., Matsumura, John M., Edwards, Sean, Everson, Robert, Gerwehr, Scott, and Gordon, John. *Denying the Widow-Maker*. Santa Monica, CA: RAND, 1998.

Gordon IV, John, and Wilson, Peter A. *The Case for Army XXI Medium Weight Aero-Motorized Divisions: A Pathway to the Army of 2020*. Carlisle Barracks, PA: Strategic Studies Institute, May 1998.

Johnson, Douglas V. *AY97 Compendium: Army After Next Project*. Carlisle Barracks, PA: Strategic Studies Institute, April 1998.

Khalilzad, Zalmay, and Ian O. Lesser. *Sources of Conflict in the 21st Century: Regional Futures and U.S. Strategy*. Santa Monica, CA: RAND, 1998.

Keegan, John. *A History of Warfare*. New York: Alfred A. Knopf, Inc., 1993.

MacGregor, Douglas A., COL. *Land Warfare Paper No. 20: Setting the Terms of Future Battle for Force XXI*. Arlington, VA: Association of the United States Army, 1995.

Matsumura, J., R. Steeb, T. Herbert, M. Lees, S. Eisenhard and A. Stich. *Analytic Support to the Defense Science Board: Tactics and Technology for the 21st Century Military Superiority*. Santa Monica, CA: RAND, 1997.

Matthews, James K. and Holt, Cora J. *So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm*. Washington, D.C.: U.S. Government printing Office, 1996.

Nichiporuk, Brian and Carl H. Builder. *Information Technologies and the Future of Land Warfare*. Santa Monica, CA: RAND, 1995.

Ogorkiewicz, R.M. *International Defense Review Special Report: Armored Reconnaissance Vehicles - Finding the Right Capability Mix*. Alexandria, VA: Jane's Information Group, 1995.

_____. *International Defense Review Special Report: Worldwide Trends in the Development of Armored Fighting Vehicles*. Alexandria, VA: Jane's Information Group, 1994.

Rosen, Stephen Peter. *Winning the Next War: Innovation and the Modern Military*. Ithaca, NY: Cornell University Press, 1991.

Steeb, R., K. Brendley, T. Covington, T. Herbert and S. Eisenhard. *The Role of Technology in Enabling Future Early Entry Forces to Fight and Survive*. Santa Monica, CA: RAND, 1995.

Sullivan, Gordon R., and James M. Dubik. *Land Warfare in the 21st Century*. Carlisle Barracks, PA: Strategic Studies Institute, U.S. Army War College, 1993.

Van Creveld, Martin. *The Transformation of War*. New York, NY: The Free Press, 1991.

Vector Research Incorporated, *The 21st Century Army: Roles, Missions, and Functions in an Age of Information and Uncertainty*. Ann Arbor, MI: Vector Research Incorporated, 1996.

Von Moltke, Graf Helmuth, Generalfeldmarschall. *Augsgewaehlte Werke I. Feldheer und Kriegsmeister*. Berlin: 1925.

Periodicals and Articles

Benson, Kevin C.M. "Armor's Role in the Future Combined Arms Team." *Armor*, March/April 1998, 48-49.

Biass, Eric H. "On the Move, Smoothly." *Armada International* 20, no. 2 (April/May 1996): 24-38.

Biass, Eric H., and Trevor Nash. "Tilting From the Vertical." *Armada International* 20, no. 6 (December 1996/January 1997): 34-40.

Biverot, Hans. "Improving the Odds: Sensors and the Science of Tank Survival." *International Defense Review* 29, no. 3 (March 1996): 28-33.

Boyd, Morris J., BG, and MAJ Michael Woodgerd. "Force XXI Operations." *Military Review*, November 1994, 17-28.

Braybrook, Roy. "Getting there is Half the Battle." *Armada International* 20, no. 2 (April/May 1996): 8-22.

Brown, Peter. "New Armored Vehicles Debut at British Equipment Exhibition?" *Armor*, January/February 1998, 50.

Buckley, Edward T., BG, Franke III, Henry G., LTC, and A. Fenner Milton. "Army After Next Technology: Forging Possibilities into Reality." *Military Review*, vol. LXXVIII, no. 2 (March/April 1998): 2-9.

Carey, Mark G. "Firepower and Maneuver: Disrupting the Balance." *Army* 48, no. 1 (January 1998): 11-14.

Combest, Michael L. "The New FM 100-5 and the Fundamentals of Fires." *Field Artillery*, September/October 1997, 5-9.

Crist, Stanley C. "The M1A2 Abrams: The Last Main Battle Tank?" *Armor*, July/August 1997, 14-16.

Dessert, Rolland A., COL. "Mobile Strike Force: An Experiment in Future Battle Command." *Military Review*, vol. LXXVI, no. 4 (July/August 1996): 34-39.

Echevarria II, Antulio J. "Tomorrow's Army: The Challenge of Nonlinear Change." *Parameters*, vol. XXVIII, no. 3 (Autumn 1998): 85-98.

Erbe, Jurgen. "Wheels or Tracks?" *Military Technology* 18, no. 7 (July 1994): 10-16.

Estes, Kenneth W. "First to the Fray: America's Contingency Corps." *International Defense Review* 28, no. 9 (September 1995): 34-41.

Franz, Wallace P., Colonel. "Airmechanization: The Next Generation." *Military Review*, vol. LXXII, no. 2 (February 1992): 59-66.

Goodman, Glenn W. "An Expeditionary Aerospace Force." *Armed Forces Journal International* 136, no. 8, (August 1998): 18-19.

_____. "Lift on Arrival." *Armed Forces Journal International* 135, no. 12, (December 1997): 45.

Gourley, Scott R. "Airborne Units Clamor for Fire Support." *International Defense Review* 29, no. 11 (November 1996): 50-53.

Grau, Lester W., Lieutenant Colonel. "Bashing the Laser Range Finder With a Rock." *Military Review*, vol. LXXVII, no. 3 (May/June 1997): 42-48.

Gregory, Bill. "Deep Prowler." *Armed Forces Journal International* 136, no. 2, (February 1998): 40.

Harris, David G., and Richard D. Stewart. "US Surge Sealift Capabilities: A Question of Sufficiency." *Parameters*, vol. XXVIII, no. 1 (Spring 1998): 67-83.

Hartzog, William W., General, and Susan Canedy. "Laying Foundations: From Army XXI to Army After Next." *Army* 48, no. 2 (February 1998): 19-21.

Hartzog, William W., General, and LTC James G. Diehl. "Building the 21st Century Heavy Division." *Military Review*, vol. LXXVIII, no. 2 (March/April 1998): 91-94.

Hewish, Mark. "At the Sword's Point: Specialized Equipment for Early-Entry Forces." *International Defense Review* 29, no. 11 (November 1996): 36-42.

_____. "Thick Skin: Up-Armoring Utility Vehicles." *International Defense Review* 30, no. 4 (April 1997): 36-38.

Hewish, Mark, and Leland Ness. "Shoot First, Ask Questions Later: Smart Tanks Learn to Fend for Themselves." *International Defense Review* 29, no. 3 (March 1996): 33-36.

Hewish, Mark, and Rupert Pengelley. "Sensors Provide Eyes and Ears for Battlefield Recce Vehicles." *International Defense Review* 31, no. 8 (August 1998): 57-61.

Hornback, Paul. "The Wheel Versus Track Dilemma." *Armor*, March/April 1998, 33-34.

Jarnot, Charles A., MAJ. "Air Mech Strike: Revolution in maneuver Warfare." *Military Review*, vol. LXXVII, no. 2 (March/April 1997): 79-86.

Jordan, Billy J., LTC, and LTC Mark J. Reardon. "Restructuring the Division: An Operational and Organizational Approach." *Military Review*, vol. LXXVIII, no. 3 (May/June 1998): 17-24.

Keating, Peter M. "Agile, Elusive Armored Killer Will Stalk 21st Century Arena." *National Defense* LXXXI, no. 520 (September 1996): 32-33.

Killebrew, Robert B. "Deterrence With A Vengeance." *Armed Forces Journal International* 136, no. 10, (October 1998): 76-81.

_____. "Focus on the Future." *Army* 48, no. 5 (May 1998): 30-38.

_____. "The Army After Next: Defining Future Landpower Challenges." *Army* 48, no. 2 (February 1998): 22-28.

_____. "The Army After Next: TRADOC's Crystal Ball Eyes the Services' Shape Beyond Force XXI." *Armed Forces Journal International* 134, no. 3, (October 1996): 36-45.

Kroesen, Frederick J. "Would You Really Rather Have Airpower?" *Army* 49, no. 1 (January 1999): 9.

Lwin, Michael R. "Maneuver Forces and Overseas Presence: It's Not in the Numbers." *Army* 48, no. 1 (January 1998): 14-16.

Meyer, Tom J. "Active Protective Systems: Impregnable Armor or Simply Enhanced Survivability?" *Armor*, May/June 1998, 7-11.

Munoz, Antonio J. Candil. "Is There Any Future For the APC?" *Military Technology* 21, no. 3 (March 1997): 100-104.

Naylor, Sean D. "Reimer Defends Strike Force Headquarters." *Army Times*, 18 January 1999, 14.

_____. "Strike Concept Could Spread." *Army Times*, 11 May 1998, 16.

_____. "Strike Force Struck Down...For Now." *Army Times*, 4 January 1999, 7.

_____. "The Future Army Debate Rages On – 2d Armored Cavalry a Trial Strike Force." *Army Times*, 20 April 1998, 12.

Ohle, David H. "Force XXI Campaign Plan." *Army*, February 1995.

Ogorkiewicz, R.M. "Improved Mine Protection Shields Armored Vehicles: Offsetting Vehicle Vulnerability to Mine Blast." *International Defense Review* 30, no. 4 (April 1997): 33-36.

_____. "Infantry Armored Vehicle Design Continues to Vary." *International Defense Review* 30, no. 8 (August 1997): 63-70.

_____. "Transforming the Tank: Battle Tanks Stand at a Crossroads of Development." *International Defense Review* 30, no. 10 (October 1997): 30-43.

O'Malley, T.J. "Improving B Team Vehicles." *Armada International* 17, no. 5 (October/November 1993): 22-30.

_____. "Light Strike or Fast Attack?" *Armada International* 17, no. 1 (February/March 1993): 35-40.

_____. "Trends in Armored Vehicles." *Armada International* 17, no. 6 (December 1993/January 1994): 12-18.

Pengelley, Rupert. "Alvis Casts Its Shadow." *International Defense Review* 29, no. 11 (November 1996): 42-44.

_____. "Steering a New Course: Light Strike Vehicles Go Mainstream." *International Defense Review* 31, no. 8 (August 1998): 51-56.

Peters, Ralph. "The Future of Armored Warfare." *Parameters*, vol. XXVII, no. 3 (Autumn 1997): 50-59.

Reimer, Dennis J., General. "Challenge and Change: A Legacy for the Future." *Military Review*, vol. LXXVII, no. 4 (July/August 1997): 108-116.

Richardson, Doug, and Jacques Lenaerts. "Equipping Rapid Deployment Forces." *Armada International* 19, no. 5 (October/November 1995): 6-22.

Roos, John G. "Striking the Best Balance." *Armed Forces Journal International* 136, no. 10, (October 1998): 46-54.

Schook, Steven P. "Paying the Price for Versatility." *Military Review*, vol. LXXVII, no. 5 (September/October 1997): 19-25.

Scott, Bruce K., Major General, and Lieutenant Colonel Robert M. Toguchi. "Strategic Dominant Maneuver." *Army* 47, no. 9 (September 1997): 20-26.

Sharoni, Asher H., and Lawrence D. Bacon. "The Future Combat System (FCS): A Technology Evolution Review and Feasibility Assessment." *Armor*, July/August 1997, 7-13.

_____. "The Future Combat System (FCS): A Technology Evolution Review and Feasibility Assessment – Part Two: The Armament." *Armor*, September/October 1997, 29-33.

_____. "The Future Combat System (FCS): Satellite-fueled, Solar-powered Tank?" *Armor*, January/February 1998, 37-42.

Shelton, Henry H., General. "Operationalizing Joint Vision 2010." *Military Review*, vol. LXXVIII, no. 3 (May/June 1998): 81-83.

Sherman, Jason. "Bulking Down." *Armed Forces Journal International* 136, no. 7, (July 1998): 32-35.

_____. "Lighten Up." *Armed Forces Journal International* 136, no. 10, (October 1998): 57-60.

_____. "Souped Up." *Armed Forces Journal International* 136, no. 5, (May 1998): 42-47.

_____. "21st Century Tank." *Armed Forces Journal International* 134, no. 10, (October 1996): 46-51.

Steele, Dennis. "Power Projection: From Standing Start to Standing Guard." *Army* 48, no. 5 (May 1998): 14-22.

_____. "The Army XXI Heavy Division – First Blueprint of the Future Army." *Army* 48, no. 7 (July 1998): 33-35.

Stilton, Giles. "Armor Systems for the Future." *Armada International* 19, no. 3 (June/July 1995): 52-60.

Stix, G. "Fighting Future Wars." *Scientific American*, December 1995, 92-98.

Sullivan, Gordon R. "Moving Into the 21st Century: America's Army and Modernization." *Military Review*, July 1993, 3-11.

"Swedish Army Considers Unconventional Armored Vehicle Design." *International Defense Review* 30, no. 8 (August 1997): 5.

"Tougher Skin, Active Defense Shield Combat Vehicle Crews." *National Defense* LXXXI, no. 526 (March 1997): 22-23.

"U.S. Army Considers Revolutionary Lightweight Tank." *International Defense Review* 31, no. 7 (July 1998): 6.

"U.S. Army Looks Toward Future Combat System Armament." *International Defense Review* 31, no. 2 (February 1998): 10.

"U.S. Army Studies FIV to Complement Bradley." *International Defense Review* 31, no. 10 (October 1998): 21.

"U.S. Army Trials French Anti-Mine Runflat." *International Defense Review* 31, no. 1 (January 1998): 16.

Waghelstein, John D. "Some Thoughts on Operation Desert Storm and Future Wars." *Military Review*, February 1992, 80-83.

Wass de Czege, Hubba. "Mobile Strike Force: A 2010 Potential Force." *Military Review*, vol. LXXVI, no. 4 (July/August 1996): 70-84.

Williams, Robert H. "Precision Weaponry, Speed, Dominance Mark Army Plan." *National Defense* LXXXI, no. 525 (February 1997): 30-31.

Government Publications

Fratzel, Margaret A. *Analysis Plan for the Army After Next: Fall Wargame, November 1996 and Winter Wargame, January-February, 1997*. Fort Leavenworth, KS: TRADOC Analysis Center, 1997.

Johnson, Douglas V. *AY97 Compendium: Army After Next Project*. Carlisle Barracks, PA: Strategic Studies Institute, April 1998.

Military Traffic Management Command Transportation Command Transportation Engineering Agency (MTMCTEA) Reference Guide 98-70-1, *Transportability and Deployability for Better Strategic Mobility*. Newport News, VA, April 1997.

Office of the Chief of Staff of the Army. U.S. Department of the Army. *America's Army of the 21st Century: Force XXI*. Pamphlet; Washington, DC: U.S. Department of the Army, 1995.

Reimer, Dennis J. *Army Vision 2010*. Pamphlet; Washington, DC: U.S. Department of the Army, 1996.

STAR 21: Strategic Technologies for the Army of the Twenty-First Century.
Washington, D.C.: National Academy Press, 1992.

U.S. Army Training and Doctrine Command. *Knowledge and Speed: The Annual Report on the Army After Next Project to the Chief of Staff of the Army.*
Washington, D.C.: U.S. Department of the Army, July 1997.

_____. *The 1998 Annual Report on the Army After Next Project to the Chief of Staff of the Army.* Washington, D.C.: U.S. Department of the Army, December 1998.

_____. *TRADOC Final Report ACN 070846, Wheeled Versus Tracked Vehicle Study.* Fort Monroe, VA: U.S. Army Training and Doctrine Command, 1985.

_____. *TRADOC Pamphlet 525-5, Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century.* Fort Monroe, VA: U.S. Army Training and Doctrine Command, 1994.

U.S. Department of the Army. *Decisive Victory: America's Power Projection Army.* Pamphlet; Washington, DC: U.S. Government Printing Office, October 1994.

_____. *Field Manual 100-5, Operations.* Washington, DC: U.S. Government Printing Office, 14 June 1993.

_____. *Field Manual 101-5-1, Operational Terms and Symbols.*
Washington, DC: U.S. Government Printing Office, 1997.

_____. *Force XXI: Meeting the 21st Century Challenge.* Pamphlet;
Washington, DC: U.S. Government Printing Office, 1995.

_____. *Revised Final Draft Field Manual 100-5, Operations.* Washington,
DC: U.S. Government Printing Office, 6 April 1998.

Monographs and Theses

Jones, Brian, MAJ. "Force XXI: What are the Risks of Building a High Tech, Narrowly Focused Army?" Monograph, U.S. Army School for Advanced Military Studies, Fort Leavenworth KS, 1996.

Nelson, Victor L., LTC. "Power projection of an Army Corps by C+75 – On target or Wishful Thinking?" Monograph, U.S. Army School for Advanced Military Studies, Fort Leavenworth KS, 1996.